BIOTIC COMMUNITY

Fish Community Data

Two fish collection/documentation periods are recognized, those made by Department fisheries management biologists between 1979-91 and those made by other collectors between 1940-85. In discussions of changes of species composition, as documented by seining, we will refer to these collections as "pre-1986" and "post-1986". Most early collection (prior to 1979) used seining. When considering both collection efforts, a total of 87 species representing 16 families have been collected in that part of the West Osage River Basin that lies in Missouri; 75 species representing 17 families have been collected in the Kansas portion of the basin (Table 46). When considering the entire basin, 18 families are represented. Seven hybrid species were collected in Missouri (Table 47). Twenty-three species collected in Missouri were not collected in Kansas, and 11 species collected in Kansas were not collected in Missouri. Also, collections made during 1991 occurred in drought conditions; low pools and dry riffles may have biased species composition.) Some changes in fish species composition are due to the construction of Truman Lake. All impacts resulting from this impoundment may not yet be fully realized or understood.

Collection Methods

For the post-1986 collection, a total of 19 stations were sampled by electrofishing, 51 by seining and three were sampled by both methods. A seine (25' x 6' x 1/4") and an electrofishing boat (DC 220 v) were used where possible. Riffles were sampled using kick-seining. Large fish were measured on-site and released. Smaller fish were either identified on-site (Harold Kerns) or were preserved (10% formalin solution) and sent to the Fish and Wildlife Research Center in Columbia for identification. Three species (chestnut lamprey, goldfish, and grass carp) listed as occurring in the basin have not been collected in nets or by electrofishing, but have been observed by biologists and others. One species (paddlefish) was collected by netting only once, but is known to have wide distribution in the basin. Species identified in basin creel surveys were included in the species listed.

Fish communities were analyzed for geographic (region of the state) and ecological (habitat type) affinities (Pflieger, 1971; 1985). Trophic guild assignments followed Karr et al. (1986) but were occasionally amended at the discretion of the investigator to reflect knowledge of local fish ecology. Species collections are summarized by subbasin below.

WEAUBLEAU SUBBASIN

A total of 66 species were collected in the subbasin. Post-1986 sampling collected 66 (all) species by seining and 36 (of the 66) species by electrofishing. Pre-1986 sampling collected 53 (of the

66) species via seining in the Ozark-boarder streams within the subbasin (Appendix F and G). Wide-ranging and Ozark-type species, as classified by Pflieger (1971), predominated and accounted for 38% and 29%, respectively, of all species collected. Others collected included Ozark-prairie species (9%), prairie (8%), big-river and Ozark-lowland species (6% each), and lowland species (4%). The minnows (Cyprinidae) were the dominant family present (19 species), followed by perches (Percidae; 12 species), suckers (Catostomidae; 11 species), sunfishes (Centrarchidae; 9 species), and catfishes (Ictaluridae; 8 species).

The following species were collected by seining at 80% of the sample sites: central stoneroller (herbivore), bluntnose minnow (omnivore), and brook silverside, bluegill, longear sunfish, and orangethroat darter (all insectivores). The western redfin shiner, blackspotted topminnow, rainbow darter, bleeding shiner, and green sunfish were collected at 60% or more of the sites. Creek habitats supported a richer fish fauna (42 species) than did headwater streams or large river habitats (27 and 19 species, respectively).

Species collected by seining in post-1986 collections included striped shiner, warmouth, and white crappie, (each occurring at 20% of the sites). Species collected by seining in pre-1986 collections (but not post-1986) include longnose gar, central stoneroller, red shiner, common carp, gravel chub, speckled chub, emerald shiner, rosyface shiner, southern redbelly dace, creek chub, white sucker, northern hogsucker, river redhorse, shorthead redhorse, black bullhead, channel catfish, freckled madtom, flathead catfish, banded sculpin, white bass, orangespotted sunfish, johnny darter, stippled darter, Missouri saddled darter, banded darter, slenderhead darter, and freshwater drum.

Electrofishing was also used in the subbasin. Bluegill (insectivore) and largemouth bass (insectivore/piscivore) were collected at 100% of the sample sites. Freshwater drum, gizzard shad, common carp, black redhorse, and longear sunfish were collected at 60% or more of the sites. All 36 species collected by electrofishing were obtained in creek habitats, but this was the only zone sampled using this method.

Sportfishes collected in the subbasin by seining and electrofishing included catfish (channel, blue, and flathead), white bass, warmouth, black bass (largemouth and spotted), crappie (white and black), and walleye. The warmouth has not been documented in more recent collections.

Temporal changes in fish species composition were caused by the construction of Truman Lake. (One early collection effort occurred in the Osage River prior to impoundment.) All impacts resulting from impoundment may not yet be fully realized or understood. Additionally, the use of the two different collection methods complicates direct comparisons of species composition between the two time periods.

Overall, the fishes of this subbasin can be characterized as tolerant, insectivorous, and dominated by Ozark species. However, some species have been characterized by Karr et.al. (1986) as being intolerant. Those obtained by seining (both pre- and post-1986 sampling) included: blacknose

shiner (state endangered), hornyhead chub, black redhorse, slender madtom, and longear sunfish. Seine collections in pre-1986 sampling included: rosyface shiner, southern redbelly dace, northern hogsucker, river redhorse, banded darter, and slenderhead darter.

MONEGAW SUBBASIN

In post-1986 sampling, a total of 56 species were collected in this subbasin, 24 species by seining and 16 species by electrofishing. In pre-1986 collections, 51 species were collected by seine in the prairie/Ozark border streams in the subbasin (Appendix F and G). Wide-ranging species, as classified by Pflieger (1971), predominated and accounted for 36% of the species collected. Others collected included Ozark species (18%), big river (16%), prairie (11%), lowland and Ozark lowland (7% each), and Ozark-prairie (5%) species. The minnows (Cyprinidae) were the dominant family present (16 species), followed by perches (Percidae; 9 species), catfishes (Ictaluridae; 8 species), sunfishes (Centrarchidae; 8 species), and suckers (Catostomidae; 4 species).

Bluegill (insectivore) were collected by seining at 70% of the sample sites. Red shiner, green sunfish, largemouth bass, and orangethroat darter were collected at 60% or more of the sites. Large river habitats supported a richer fish fauna (38 species) than did creeks or headwater streams (27 and 24 species, respectively).

The only species collected during post-1986 sampling, but not in pre-1986 sampling was black crappie. Species collected by pre-1986 seining, but not post-1986 seining included: paddlefish, longnose gar, gizzard shad, goldeye, common carp, speckled chub, silver chub, hornyhead chub, emerald shiner, ghost shiner, blacknose shiner, rosyface shiner, white sucker, black bullhead, stonecat, freckled madtom, flathead catfish, white bass, spotted bass, greenside darter, striped fantail darter, slough darter, Missouri saddled darter, banded darter, slenderhead darter, walleye, and freshwater drum.

Electrofishing was also used in the subbasin. Gizzard shad (omnivore) and channel catfish (insectivore/piscivore) were collected at 100% of the sample sites. Smallmouth buffalo (insectivore), bigmouth buffalo (insectivore/piscivore), and white crappie (insectivore/piscivore) were collected at 60% or more of the sites. Large river habitats supported a richer fish fauna (16 species) than did creek habitats (9 species).

Sportfish collected in the subbasin by seining and electrofishing included: paddlefish, catfish (channel, blue, and flathead), white bass, warmouth (not documented in post-1986 collections), black bass (largemouth and spotted), crappie (white and black), and walleye.
Changes in species composition of fishes collected may reflect changes caused by the construction of Truman Lake. (Three early samples by seining were in areas now impounded.)

Overall, the fishes of this subbasin can be characterized as tolerant, insectivorous, and wide-ranging. However, some species have been characterized by Karr et.al. (1986) as being

intolerant. Those obtained by seining (pre- and post-1986 sampling) included: the hornyhead chub, slender madtom and longear sunfish. Intolerant species collected in pre-1986 sampling but not post-1986 collections included: blacknose shiner (state endangered), rosyface shiner, banded darter, and slenderhead darter.

CLEAR CREEK SUBBASIN

Seines were used to collect a total of 37 fish species (19 by post-1986 sampling and 32 by pre-1986 sampling) in the prairie streams within this subbasin (Appendix F). Wide-ranging species, as classified by Pflieger (1971), predominated and accounted for 35% of all species collected. Ozark, Ozark-prairie, and prairie species accounted for 19%, 14%, and 11%, respectively, of the total; lowland and Ozark-lowland contribute 8% each, and big river species 5%. The dominant family present was minnows (Cyprinidae; 11 species), followed by the sunfishes (Centrarchidae; 7 species), perches (Percidae; 7 species), and catfishes (Ictaluridae; 4 species).

Green sunfish (insectivore/piscivore) were collected by seining at 69% of the sample sites. Two omnivores (red shiner and bluntnose minnow) and an insectivore (brook silverside) were collected at 60% or more of the sites. Creek and small river habitats supported a richer fish fauna (26 and 25 species, respectively) than did headwater streams (10 species).
Species collected by post-1986 sampling, but not pre-1986 sampling included: shortnose gar, gizzard shad, redear sunfish, black crappie, and freshwater drum. Species collected by pre-1986 sampling, but not post-1986 sampling included: hornyhead chub, golden shiner, ghost shiner, rosyface shiner, sand shiner, suckermouth minnow, creek chub, white sucker, yellow bullhead, slender madtom, longear sunfish, bluntnose darter, striped fantail darter, slough darter, johnny darter, orangethroat darter, logperch, and slenderhead darter.

Sportfishes collected in the subbasin included: channel catfish, largemouth bass, and white and black crappie.

Overall, the fishes of this subbasin can be characterized as tolerant, insectivorous, and wide-ranging. However, four species (rosyface shiner, hornyhead chub, slender madtom, longear sunfish, and slenderhead darter) collected in post-1986 collections were characterized by Karr et.al. (1986) as being intolerant.

MARAIS DES CYGNES RIVER SUBBASIN

A total of 48 species of fishes were collected in this subbasin; post-1986 sampling collected 20 species by seining and 20 species by electrofishing and pre-1986 sampling collected 43 species by seining in the prairie streams of this subbasin (Appendix F and G). Wide-ranging species, as classified by Pflieger (1971), predominated and accounted for 40% of the species collected. Others collected included prairie (18%), big river (11%), lowland, Ozark, and Ozark-prairie (all 9% each), and Ozark-lowland (4%). The minnow family (Cyprinidae) dominant (14 species), followed by catfishes (Ictaluridae; 8 species), suckers (Catostomidae; 7 species), sunfishes

(Centrarchidae; 6 species), and perches (Percidae; 5 species).

Bluegill (insectivore) and largemouth bass (insectivore/piscivore) were collected by seining at 58% of the sample sites. Red shiner, green sunfish, and white crappie were collected at 50% or more of the sites. Small river habitats supported a richer fish fauna (43 species) than did creeks (26 species). However, headwater stream and large river habitats were not sampled.

The only species collected by post-1986 seining, but not pre-1986 seining were brook silverside and spotted bass. Species collected by pre-1986 seining, but not post-1986 seining included: longnose gar, shortnose gar, central stoneroller, silver chub, hornyhead chub, emerald shiner, ghost shiner, suckermouth minnow, fathead minnow, river carpsucker, white sucker, smallmouth buffalo, bigmouth buffalo, black bullhead, stonecat, tadpole madtom, freckled madtom, flathead catfish, slough darter, orangethroat darter, logperch, slenderhead darter, walleye, and freshwater drum.

Electrofishing was also used in the subbasin. Common carp (omnivore), smallmouth buffalo (insectivore), channel catfish (insectivore/piscivore), and flathead catfish (piscivore) were sampled at 75% of the sites. All 20 species collected by electrofishing were obtained in small river habitats, but this was the only habitat sampled using this method.

Sportfish collected in the subbasin by seining and electrofishing included: catfish (channel, blue, and flathead), white bass, black bass (largemouth and spotted), white crappie, and walleye.

Overall, the fishes of this subbasin can be characterized as tolerant, insectivorous, and wide-ranging. However, some species have been characterized by Karr et.al. (1986) as being intolerant. Those intolerant species obtained by seining in pre-1986 samples were hornyhead chub, tadpole madtom and slenderhead darter. Intolerant species collected by electrofishing in post-1986 collections were river redhorse.

MARMATON SUBBASIN

A total of 49 fish species were collected in the prairie streams of the subbasin; post-1986 sampling collected 35 species by seine and 13 species by electrofishing (Appendix F and G). Pre-1986 sampling collected 37 species by seining (Appendix F). Wide-ranging species, as classified by Pflieger (1971), predominated and accounted for 35% of the species collected. Others collected included: prairie species (17%), Ozark (14%), big river (12%), lowland (10%), Ozark-prairie (8%), and Ozark-lowland (4%). The minnows (Cyprinidae) were the dominant family present (15 species), followed by catfishes (Ictaluridae; 10 species), sunfishes (Centrarchidae; 9 species), and perches (Percidae; 6 species).

Red shiner (omnivore) and bluegill (insectivore) were seined at 75% of the sites. The central stoneroller, green sunfish, and white crappie were collected at 60% or more of the sites. Creek and large river habitats supported a richer fish fauna (40 and 32 species, respectively) than did

small rivers (14 species) or headwater streams (7 species).

Species collected by post-1986 sampling, but not pre-1986 sampling were: gizzard shad, speckled chub, silver chub, creek chub, smallmouth buffalo, white bass, longear sunfish, redear sunfish, black crappie, logperch, and freshwater drum. Species collected by pre-1986 sampling, but not post-1986 sampling were: longnose gar, common carp, hornyhead chub, ghost shiner, fathead minnow, river carpsucker, yellow bullhead, slender madtom, tadpole madtom, flathead catfish, greenside darter, striped fantail darter, and slough darter.

Electrofishing was also used in the subbasin. Gizzard shad, common carp (both omnivores), smallmouth buffalo (insectivore), and freshwater drum (insectivore/piscivore) were collected at 100% of the sites. Channel catfish (insectivore/piscivore) were present at 75% of the sites. All species collected by electrofishing were obtained in small river and large river habitats, but these were the only habitats sampled using this method. Sport fish collected included: catfish (channel, blue, and flathead), white bass, largemouth bass, and crappie (white and black).

Overall, the fishes of this subbasin can be characterized as tolerant, insectivorous, and wide-ranging. However, some species have been characterized by Karr et.al. (1986) as being intolerant. Intolerant species collected by seining included: longear sunfish (post-1986), hornyhead chub, slender madtom and tadpole madtom (pre-1986), and slenderhead darter (post-1986). The one intolerant species collected by electrofishing was the longear sunfish.

DRY WOOD SUBBASIN

Seines were used to collect a total of 32 fish species (27 post-1986 and 26 pre-1986) in the prairie streams within this subbasin (Appendix F). Wide-ranging species, as classified by Pflieger (1971), predominated and accounted for 41% of the species collected. Prairie and Ozark-prairie species accounted for 16% each, and lowland, Ozark, and lowland-Ozark groups accounted for 9% each. The big-river faunal group was not represented. The minnows (Cyprinidae) were the dominant family present (10 species), followed by the sunfishes (Centrarchidae; 7 species), perches (Percidae; 5 species), and catfishes (Ictaluridae; 3 species).

Bluegill (insectivore) were collected by seining at 80% of the sites. Two other insectivores, the western redfin shiner and blackstripe topminnow, were collected at 75% of site locations. The red shiner, creek chub, green sunfish, and orangethroat darter were collected at 60% or more of the sites. Creek and headwater stream habitats supported a richer fish fauna (28 and 22 species, respectively) than did small rivers (18 species).

Species collected by post-1986 sampling, but not pre-1986 sampling included: gizzard shad, mosquitofish, and slenderhead darter (each occurring at 20% of the sites), longnose gar, slender madtom, and blackspotted topminnow (each occurring at 10% of the sites). Species collected in pre-1986 samples but not post-1986 samples included: suckermouth minnow, fathead minnow, warmouth, slough darter, and Johnny darter.

Sportfishes collected in the subbasin included: largemouth bass, white crappie, and warmouth (the warmouth has not been documented in the post-1986 collections). However, it should be noted that seining, the only collection method used, may be biased against the capture of larger fish.

Little temporal change was noted in species composition. This subbasin is probably the least affected by the construction of Truman Lake. Overall, the fishes of this subbasin can be characterized as tolerant, insectivorous, and wide-ranging. However, three species (slender madtom, longear sunfish, and slenderhead darter) were characterized by Karr et.al. (1986) as being intolerant.

Aquatic Invertebrates

No detailed surveys of aquatic invertebrates, including freshwater naiades or crayfish in the basin, have been published. However, 36 species of naiades are expected to occur in the basin in Missouri, and nine species have been collected incidentally by Department fisheries management biologists (Table 48). Historically, four of the nine species collected by Department fisheries management biologists were harvested for the commercial button industry. Today, 6 of the 9 species are used by the cultured pearl industry, and the potential for illegal harvest exists. A total of 28 species of mussels have been collected in the basin in Kansas (Table 49). Five species of crayfish occur in both the Missouri (Pflieger, 1987) and Kansas (Williams and Leonard, 1952; Table 50) portions of the basin.

Threatened and Endangered Species

Table 51 lists species in the basin that have been assigned special status. In the Missouri (MDC 1991b, Pflieger 1975) portion, two species of fish are classified as rare (mooneye and blacknose shiner) and two are listed on the "watch list" (ghost shiner and paddlefish). In Kansas (Bill Bosby, Kansas Natural History Inventory, personal communication), one species (hornyhead chub) is listed as threatened. Two species of naiades are considered rare in Missouri (flat floater and rock pocketbook), and two others are on the state watch list (spectacle case and hickory-nut; MDC 1991b, Pflieger 1975). The spectacle case is a candidate for federal listing. In Kansas, one species is classified as endangered (flat floater), and another is considered threatened (rock pocketbook; Bill Bosby, KNHI, personal communication). No species of crayfish are listed as rare, endangered or state threatened in either Missouri or Kansas.

In February of 1990, 20 river otters (*Lutra canadensis*) were released on Dry Wood Creek near the Barton-Vernon county line as part of an eight year, state-wide restoration program. Reproduction has been verified in many areas of the state and the program is generally considered a success.

Fish Introductions

Several fish species have been stocked into Truman Lake. Only three, the tiger muskie, the striped bass, and the hybrid striped bass were not native to the area. Currently, two species are stocked on a regular basis (hybrid striped bass and paddlefish). One goal of the approved Truman Lake Management Plan (MDC 1989b) is to sustain a trophy hybrid striped bass fishery. To this end, 150,000 2-inch hybrid-striped bass are stocked annually. Conservation agents have reported that anglers have caught white bass and hybrid striped bass during spring spawning runs up tributary streams, and hybrid striped bass were documented in creel surveys on Truman Lake. Other species introduced by anglers, agencies or aquaculturists include the common carp, mosquitofish and spotted bass. Goldfish have escaped or been released by anglers and commercial hatcheries. Grass carp, usually introduced into ponds for weed control, have expanded their range via flood events and are now found in flowing waters of the basin. The extent of fish stocking activity undertaken in the Kansas portion of the basin is unknown, as are the potential or realized impacts on Missouri's fish fauna.

Sportfishery/Creel Data

The basin supports a large and diverse sportfishery that includes: walleye, paddlefish, crappie (black and white), black bass (largemouth, spotted, and smallmouth), white and hybrid-striped bass, and catfish (blue, flathead, and channel). A statewide angler survey conducted by Weithman (1991) indicates that angler effort increased on the Osage River between 1983 and 1988. Statewide, the most sought sportfish, in order of preference, are largemouth bass (33%), crappies (20%), and catfish (19%) (Weithman 1991). The Marmaton and Marais des Cygnes rivers are well known for their paddlefish, walleye, catfish, white bass, and crappie fisheries. The Marmaton River is locally well-known for it's trophy-size flathead and blue catfish, particularly when the river is at flood stage. A survey of the professional staff of public agencies involved in resource management gave the basin a high ranking for recreational value and expected the ranking to increase in the future (Bachant et.al. 1982). The region's proximity to the Kansas City and Joplin areas enhances its present and future recreational significance. Because of the diversity of the sportfishery within the basin, individual species, creel information, and locations of special significance will be addressed individually.

Harry S. Truman Lake

Truman Lake is a 55,600 acre impoundment constructed by the U.S. Army Corps of Engineers for the purposes of flood control, hydropower generation, and recreation. Truman Dam impounds portions of the South Grand, Osage, Sac, and Pomme de Terre rivers, as well as numerous smaller tributaries. The lake has 958 miles of shoreline and an average depth of 22 feet (at multi-purpose pool elevation of 706 ft. m.s.l. Impacts of impounding these streams are far-reaching and include: inundation of numerous tributaries, alteration or elimination of spawning areas, competition of lake fishes with stream species, and frequent fluctuations of the reservoir's pool size and depth. The full effects of impoundment on stream habitat and biota are probably not

yet fully realized or understood. During extreme flooding in 1993-95, considerable mortality of trees in the riparian corridor occurred. Revegation of the riparian corridors with woody species may be a recurring problem during wet years and may increase erosion of streambanks up to elevation 739 ft. m.s.l.

Truman Lake is very popular with anglers, which results in heavy fishing pressure. Sport-fish, in order of importance, include: crappie (white and black), black bass (largemouth and spotted), white bass, catfish (channel, blue, and flathead), hybrid striped bass, sunfish, and walleye. Stocking contributes to the diversity of the fishery (Table 52). See Wildlife Code of Missouri for current seasons, limits, and regulations.

Fish populations are monitored on a regular basis. Fish population and angler data are collected using standard methods in accordance with the Truman Lake Management Plan (MDC 1989b). Black bass populations are evaluated by spring night-electrofishing. Crappie populations are monitored by fall trapnetting at established sites on the upper and lower Osage arms of the lake. Angler surveys on the Grand, Pomme, and Osage arms of the lake are conducted from April through October (MDC 1989b). In 1992, a pilot study of the catfish fishery was initiated on Truman Lake and the Osage, Marmaton, and Marais des Cygnes rivers. (For more information on fish population or angler data, contact Missouri Department of Conservation, 1014 Thompson Blvd., Sedalia, MO 65301, (816/530-5500).

Walleye

Currently, Truman Lake has a low-density, self-sustaining walleye population. Walleye spawn primarily in riffles on the Marais des Cygnes, Sac, and Pomme de Terre rivers. The most active fishery has developed on the Marais des Cygnes and Sac rivers during the spawning run. Spawning habitat on the Marais des Cygnes River is primarily rubble (limestone/shale rock) with strong current. Channelization of the river has caused down-cutting to bedrock in most reaches and results in rapid changes in stream gradient over short distances in a "staircase-like" effect. Walleye spawning activity has been documented on seven of the 12 riffles known to occur on the Marais des Cygnes River (Ron Dent, MDC, personal communication). One of the largest spawning riffles is located on the Department's Old Town C.A. just below Highway 71.

In 1986, based on electrofishing samples, the Marais des Cygnes River had the highest density of walleye (22/hr) in the basin. The Marais des Cygnes River provides easy access to anglers because of its proximity to Kansas City and because spawning riffles are located near roadways (Figure 9). In 1986, almost 2.2 million walleye fry and approximately 180,000 2-5" fingerlings were stocked into Truman Lake to increase the number of young walleye that would eventually mature and sustain the population. A total of 150 walleye larger than 14" were tagged with reward tags in 1986 to document exploitation. Returned tags showed that most walleye were caught within two months after tagging, and indicated an exploitation rate of 8% (Ron Dent, MDC, personal communication). During the spring 1986 spawning run on the Marais des Cygnes River, approximately 34% of the anglers caught at least one walleye (Ron Dent, MDC, personal

communication). It should be noted that walleye spawning riffles are also extensively used by white bass and redhorse species. Since spawning habitat is limited on the Marais des Cygnes River, it is imperative that these riffles be preserved.

Paddlefish

Closure of the Harry S. Truman Dam in 1977 eliminated many traditional paddlefish spawning areas. (See page 94 in the Habitat section for additional information concerning the status of paddlefish spawning activities and habitat.) A paddlefish population is maintained in Truman Lake by stocking 10,000-25,000 paddlefish fingerlings (10-12") annually into the lake's Osage Arm (MDC 1989b, 1992). Stocking began in 1978 and the population developed rapidly. A snag fishery was permitted in 1990 under statewide regulations of two fish per day (four fish in possession), during a 45-day season (March 15 - April 30), with a 24-inch length limit (measured from eye to fork-of-tail). During high-water conditions in the spring, paddlefish migrate up the Marais des Cygnes River on their spawning run, and a few fish are also found on the Marmaton River. Fish moving up the Marais des Cygnes River during high-water conditions occasionally become stranded in pools during rapid changes in water level caused by changes in discharge from three Corps of Engineers dams in Kansas. Paddlefish stranded in isolated pools are vulnerable to angler harvest. Popular and productive locations for bank snagging include: the Marble Bridge area on V Highway just south of the town of Virginia, the Haymaker area north of the town of Foster, and in the vicinity of Old Town access. Boat snagging is successful below the "cut" (the juncture of the Bates County Drainage Ditch and the Marais des Cygnes River) near Prairie City during normal water conditions, and above the "cut" during periods of high water. All of the above sites are located in Bates Co. (Figure 9). St.Clair Co. snag anglers are successful from boats above Osceola, and from the bank at any location affording access on the Osage Arm of Truman Lake. Kansas snag fishermen pursue paddlefish in the only area open to paddlefish snagging below Osawatamie dam in Kansas.

Because anglers typically move with the fish, two creel surveys are conducted, the roving creel on the Osage River and the site-probability creel on the Marais des Cygnes River. The roving survey is conducted on the Osage Arm from Osceola upstream to the "cut" during the entire season. The site-probability creel is conducted on the Marais des Cygnes River only during periods of high water when the fish are migrating upriver into Kansas, and only at selected bridge sites (Figure 9). From 1990 to 1992, paddlefish snagging fishing pressure and harvest has increased without significantly changing the catch rate (Table 54). The average paddlefish harvested is 37 inches long and weighs 42 pounds. The current state record paddlefish taken from the Osage River near Clear Creek weighed 130 pounds. Statewide, the goal of the paddlefish management program is to manage paddlefish as a trophy sportfishery where the average weight of harvested paddlefish is 30 pounds or more, with at least 20% of harvested paddlefish weighing 50 pounds or more (MDC 1992). Additional information concerning paddlefish can be obtained from the Missouri Department of Conservation, 1014 Thompson Blvd., Sedalia, MO 65301.

Sportfishing/Harvest Regulations

See Wildlife Code of Missouri for current seasons, limits, and regulations.

Information Needs

Paddlefish

Maintenance of the paddlefish fishery will remain a high priority. Plans call for a paddlefish creel survey to be continued on Truman Lake through the year 2001. Information obtained from the creel survey will be used to evaluate stocking, harvest and regulations.

Past research has focused on developing effective hatchery production methods, stocking rates, and procedures (MDC 1992). Currently, some anglers have expressed concern about the status of the paddlefish fishery and believe that present harvest regulations are too liberal. Effective management requires that personnel have information concerning movement, growth and the age structure of the paddlefish population. Starting in fall 1994, the Department and the U.S. Fish & Wildlife Service began tagging paddlefish stocked into Truman Lake with binary-coded wire tags. Since paddlefish from Truman Lake emigrate through its dam and into Lake of the Ozarks, a second creel survey will be initiated on Lake of the Ozarks in 1999 to determine the contribution of Truman Lake fish to the Lake of the Ozarks fishery. The information obtained through tag recovery will guide management activities for paddlefish in Truman Lake and the Marais des Cygnes River.

Catfish

In terms of angler effort, catfish (channel, blue and flathead) are the fourth most important sportfish at Truman Lake (MDC 1989b). Jug-lines and trot-lines are in wide use and are effective means of harvest. Some local residents have expressed concern about the large numbers of large catfish being taken and question if the resource can sustain harvest at present levels (Ron Dent, Kim Graham, and John Hart; MDC, personal communication). The size distribution, abundance, growth, mortality, recruitment and harvest rate of catfish populations are unknown. Given the importance of the Truman Lake catfish fishery, research should be undertaken to determine the current status of the catfish population in Truman Lake and the effects of current harvest regulations on recruitment, growth and mortality. Monitoring the catfish fishery and continuing a pilot study on Truman Lake to investigate fishing pressure, gear types and success rates, and age and growth information should be undertaken.

Gar

B.L. Johnson, a University of Missouri-Columbia student recently completed research concerning the breeding migrations and population demographics of longnose gar in Weaubleau Creek. Results are detailed in the thesis entitled "Migration and population demographics of stream-

spawning longnose gar (*Lepisosteus osseus*) in Missouri". For further information and/or copies this study, contact Dr. Douglas Noltie, 112 Stephens Hall, UMC, Columbia, MO 65211.

Naiades

According to Oesch (1984), freshwater mussels were once found throughout the basin. Beginning at the turn of the century, huge quantities were harvested for the button industry, and by the 1930s stocks were seriously depleted. Natural re-population of mussel-beds were hampered by increased pollution and siltation, and by declines in the abundance of fish populations necessary for completion of the mussels' life cycle. Harvest of mussels for the button industry in Missouri effectively ended in 1976. However, recent interest in using freshwater mussel shells to "seed" the saltwater commercial oyster industry in Japan has presented a new threat to overharvest of several thick shelled mussel species. Mussels continue to struggle to maintain their current population status throughout Missouri (Oesch 1984).

Changes in water quality can significantly affect the health and status of aquatic communities. Freshwater mussels are often the first aquatic organisms adversely affected by deterioration of water quality. Consequently, changes in mussel abundance and distribution may indicate changes in water quality that may adversely affect resident fish populations (Cummings and Mayer 1992).

In the Midwest, more than half of known mussel species are threatened or endangered (Cummings and Mayer 1992). Because of the lack of a thorough and recent survey of mussels in the Missouri portion of the basin and the fact that the mussels are an "indicator species", a study should be undertaken to determine the status of the mussels. This information would be valuable in identifying and eliminating possible sources of pollution that may impact stream biota.

Table 46. Species of fishes known to occur in the West Osage River Basin of Missouri and Kansas. (MO: MDC, Pflieger 1975. KS: University of Kansas Museum of Natural History (KNHI), Kansas Wildlife & Parks.)

SPECIES	COMMON NAME	OCCURRENCE	
		MO	KS
Petromyzontidae (Lampreys)			
Ichthyomyzon castaneus	Chestnut lamprey	x	x
Polyodontidae (Paddlefishes)			
Polyodon spathula	Paddlefish	x	x
Lepisosteidae (Gars)			
Lepisosteus osseus	Longnose gar	x	x
Lepisosteus platostomus	Shortnose gar	x	x
Amiidae (Bowfins)			
Amia calva	Bowfin		x
Clupeidae (Herrings)			
Dorosoma cepedianum	Gizzard shad	x	x
Hiodontidae (Mooneyes)			
Hiodon alosoides	Goldeye	x	x
Hiodon tergisus	Mooneye	x	
Esocidae (Pikes)			
Esox lucius	Northern pike		x
Cyprinidae (Minnows)			
Campostoma anomalum	Central stoneroller	x	x
Campostoma oligolepis	Largescale stoneroller	x	
Carassius auratus	Goldfish	x	x
Ctenopharyngodon idella	Grass carp	x	x
Cyprinella lutrensis	Red shiner	x	x
Cyprinus carpio	Common carp	x	x
Erimystax x-punctatus	Gravel chub	x	
Hybognathus placitus	Plains minnow		x
Luxilus chrysocephalus	Striped shiner	x	
Luxilus zonatus	Bleeding shiner	x	
Lythrurus umbratilis	Redfin shiner	x	x
Macrhybopsis aestivalis	Speckled chub	x	

Table 46. Continued.

SPECIES	COMMON NAME	OCCURRENCE MO	OCCURRENCE KS
Macrhybopsis storeriana	Silver chub	x	x
Nocomis biguttatus	Hornyhead chub	x	x
Notemigonus crysoleucas	Golden shiner	x	x
Notropis atherinoides	Emerald shiner	x	x
Notropis buchanani	Ghost shiner	x	x
Notropis heterolepis	Blacknose shiner	x	
Notropis nubilus	Ozark minnow	x	
Notropis rubellus	Rosyface shiner	x	x
Notropis stramineus	Sand shiner	x	x
Notropis topeka	Topeka shiner		x
Phenacobius mirabilis	Suckermouth minnow	x	x
Phoxinus erythrogaster	Southern redbelly dace	x	x
Pimephales notatus	Bluntnose minnow	x	x
Pimephales promelas	Fathead minnow	x	x
Semotilus atromaculatus	Creek chub	x	x
Scardinius erythrophthalmus	Rudd		x
Catostomidae (Suckers)			
Carpiodes carpio	River carpsucker	x	x
Carpiodes cyprinus	Quillback	x	
Catostomus commersoni	White sucker	x	x
Hypentelium nigricans	Northern hog sucker	x	x
Ictiobus bubalus	Smallmouth buffalo	x	x
Ictiobus cyprinellus	Bigmouth buffalo	x	x
Ictiobus niger	Black buffalo	x	x
Minytrema melanops	Spotted sucker	x	x
Moxostoma anisurum	Silver redhorse	x	
Moxostoma carinatum	River redhorse	x	x
Moxostoma duquesnei	Black redhorse	x	
Moxostoma erythrurum	Golden redhorse	x	x
Moxostoma macrolepidotum	Shorthead redhorse	x	x
Ictaluridae (Catfishes)			
Ameiurus melas	Black bullhead	x	x
Ameiurus natalis	Yellow bullhead	x	x
Ameiurus nebulosus	Brown bullhead		x
Ictalurus furcatus	Blue catfish	x	x
Ictalurus punctatus	Channel catfish	x	x
Noturus exilis	Slender madtom	x	x

Table 46. Continued.

SPECIES	COMMON NAME	OCCURRENCE MO	OCCURRENCE KS
Noturus flavus	Stonecat	x	x
Noturus gyrinus	Tadpole madtom	x	x
Noturus nocturnus	Freckled madtom	x	x
Pylodictis olivaris	Flathead catfish	x	x
Cyprinodontidae (Killifishes)			
Fundulus notatus	Blackstripe topminnow	x	x
Fundulus olivaceus	Blackspotted topminnow	x	
Peociliidae (Livebearers)			
Gambusia affinis	Mosquitofish	x	x
Atherinidae (Silversides)			
Labidesthes sicculus	Brook silverside	x	x
Cottidae (Sculpins)			
Cottus carolinae	Banded sculpin	x	
Percichthyidae (Sea basses)			
Morone chrysops	White bass	x	x
Morone saxatilis	Striped bass	x	x
Centrarchidae (Sunfishes)			
Lepomis cyanellus	Green sunfish	x	x
Lepomis gulosus	Warmouth	x	x
Lepomis humilis	Orangespotted sunfish	x	x
Lepomis macrochirus	Bluegill	x	x
Lepomis megalotis	Longear sunfish	x	x
Lepomis microlophus	Redear sunfish	x	x
Micropterus dolomieu	Smallmouth bass	x	x
Micropterus punctulatus	Spotted bass	x	x
Micropterus salmoides	Largemouth bass	x	x
Pomoxis annularis	White crappie	x	x
Pomoxis nigromaculatus	Black crappie	x	x
Percidae (Perches)			
Etheostoma blennioides	Greenside darter	x	x
Etheostoma caeruleum	Rainbow darter	x	
Etheostoma chlorosomum	Bluntnose darter	x	x

Table 46. Continued.

SPECIES	COMMON NAME	OCCURRENCE		
		MO	KS	
Etheostoma flabellare	Fantail darter	x		x
Etheostoma f. lineolatum	Striped fantail darter	x		
Etheostoma gracile	Slough darter	x		
Etheostoma nigrum	Johnny darter	x	x	
Etheostoma punctulatum	Stippled darter	x		
Etheostoma spectabile	Orangethroat darter	x	x	
Etheostoma tetrazonum	Missouri saddled darter	x		
Etheostoma zonale	Banded darter	x		
Perca flavescens	Yellow perch		x	
Percina caprodes	Logperch	x	x	
Percina phoxocephala	Slenderhead darter	x	x	
Stizostedion vitreum	Walleye	x	x	
Sciaenidae (Drums)				
Aplodinotus grunniens	Freshwater drum	x	x	

Table 47. Hybrid species of fishes known to occur in the West Osage River Basin of Missouri (MDC Pflieger, 1975).

SPECIES	**COMMON NAME**
Cyprinidae (Minnows)	
Carassius auratus x Cyprinus carpio	Goldfish x Common carp
Notropis nubilus x Luxilus Zonatus	Ozark minnow x Bleeding shiner
Percichthyidae (Sea basses)	
Morone saxatilis x Morone chrysops	Striped bass x White bass
Centrarchidae (Sunfishes)	
Lepomis cyanellus x Lepomis humilis	Green sunfish x Orangespotted sunfish
Lepomis cyanellus x Lepomis macrochirus	Green sunfish x Bluegill
Lepomis macrochirus x Lepomis megalotis	Bluegill x Longear sunfish
Micropterus dolomieu x Micropterus punctulatus	Smallmouth bass x Spotted bass

Table 48. Mussels expected to occur in the West Osage River Basin in west-central Missouri (Oesch 1984). Mussels incidently collected by Department fisheries biologists (MDC) are noted.

SPECIES	COMMON NAME	MDC	COMMERCIAL USE*
Alasmidonta marginata	Elk toe		N
Amblema plicata	Three-ridge	X	CP, PC, B
Anodonta grandis grandis	Giant floater		N
Anodonta imbecilis	Paper pond shell		N
Arcidens confragosus	Rock pocketbook		N
Cumberlandia monodonta	Spectacle case		N
Cyclonaias tuberculata	Purple pimpleback		N
Cyprogenia aberti	Western fan-shell		N
Ellipsaria lineolata	Butterfly		CP, PC, B
Elliptio dilatata	Lady-finger	X	N / P - PC
Fusconaia flava	Wabash pig-toe		CP, PC, B
Lampsilis teres anodontoides	Yellow sand shell		IM, PC, B
Lampsilis teres teres	Slough sand shell		IM, PC, B
Lampsilis radiata luteola	Fat mucket		PC, B
Lampsilis ventricosa	Pocketbook		PC, B
Lasmigona complanata	White heel-splitter	X	N / P - PC
Lasmigona costata	Fluted shell		N
Leptodea fragilis	Fragile paper shell	X	N
Ligumia recta	Black sand shell		IM, B
Ligumia subrostrata	Pond mussel		N
Megalonaias nervosa	Washboard		CP, B
Obliquaria reflexa	Three-horned warty-back		N / P - PC
Obovaria olivaria	Hickory-nut		N
Pleurobema coccineum	Round pig-toe	X	PC, B
Potamilus alatus	Pink heel-splitter		N / P - PC
Potamilus ohioensis	Pink paper shell		N
Quadrula metanevra	Monkey-face		CP, PC, B
Quadrula pustulosa	Pimple-back		CP, PC, B
Quadrula quadrula	Maple leaf	X	CP, B
Strophitus u. undulatus	Squaw foot		N
Toxolasma parvus	Lilliput shell		N
Tritogonia verrucosa	Buckhorn / Pistol-grip	X	CP, B
Truncilla donaciformis	Fawn's foot		N
Truncilla truncata	Deer-toe	X	N
Uniomerus tetralasmus	Pond-horn	X	N
Venustaconcha e. ellipsiformis	Ellipse		N

*N = none, P = potential use, CP = cultured pearl, PC = polished chip, I = inlay material, B = button (historically)

Table 49. Mussels collected from the West Osage River Basin in Kansas by the Kansas Biological Survey (Bill Bosby, KNHI, personal communication).

SPECIES	COMMON NAME
Actinonaias carinata	Mucket
Actinonaias ellipsiformi	Ellipse
Amblema plicata	Three-ridge
Anodonta grandis	Giant floater
Anodonta imbecilis	Paper pond shell
Arcidens confragosus	Rock pocketbook
Elliptio dilatatus	Spike
Fusconaia flava	Wabash pig-toe
Lampsilis ovata	Pocketbook
Lampsilis radiata	Fat mucket
Lampsilis teres	Yellow sand shell
Lasmigona complanata	White heel-splitter
Leptodea fragilis	Fragile paper shell
Ligumia recta	Black sand shell
Ligumia subrostrata	Pond mussel
Megalonaias gigantea	Washboard
Obliquaria reflexa	Three-horned warty-back
Pleurobema cordatum	Ohio pig-toe
Proptera alatus	Pink heel-splitter
Potamilis ohioensis	Pink paper shell
Proptera purpuratus	Purple shell
Quadrula pustulosa	Pimple-back
Quadrula quadrula	Maple leaf
Strophitus undulatus	Squaw foot
Tritogonia verrucosa	Pistol-grip
Truncilla donaciformis	Fawn's foot
Truncilla truncata	Deer-toe
Uniomerus tetralasmus	Pond-horn

Table 50. Crayfish occurring in the West Osage River Basin in west-central Missouri (Pflieger 1989) and Kansas (Williams & Leonard, 1952).

SPECIES	COMMON NAME
Cambarus diogenes	Devil crayfish
Orconectes immunis	Papershell crayfish
Orconectes virilis	Northern crayfish
Oronectes luteus	Golden crayfish
Procambarus gracilis	Prairie crayfish

Table 51. Endangered, rare, and threatened species of fish and mussels known to occur in the West Osage River Basin in west-central Missouri and east-central Kansas (MDC 1991, Pflieger 1975, Bill Busby, KNHI, Busby, KNHI, personal communication).

CATEGORY	SPECIES	COMMON NAME	FEDERAL STATUS	STATE STATUS
Fish:	Hiodon tergisus	Mooneye		R (MO)
	Nocomis biguttatus	Hornyhead Chub		T (KS)
	Notropis buchanani	Ghost Shiner		WL (MO)
	Notropis heterolepis	Blacknose Shiner		R (MO)
	Polyodon spathula	Paddlefish		WL (MO)
Mussels:	Anodonta suborbiculata	Flat Floater		E (KS)
	Arcidens confragosus	Rock-Pocketbook		T (KS) R (MO)
	Cumberlandia monodonta	Spectacle Case	C2	WL (MO)
	Obovaria olivaria	Hickory-nut		WL (MO)

E = Endangered R = Rare T = Threatened WL = Watch List C2 = Candidate for Federal Listing

Table 52. Species, size, and number of fishes stocked into Harry S. Truman Lake in the West Osage River Basin in west-central Missouri between 1977 and 1998.

SPECIES	COMMON NAME	SIZE (inches)	NUMBER
Morone saxatilis x	Hybrid Striped Bass	1.0 - 2.0	1,437,872
Morone chrysops		2.1 - 4.0	415,982
		4.1 - 6.0	62,631
		6.1 - 8.0	11,931
Polyodon spathula	Paddlefish	8.1 - 10.0	1,100
		10.1 - 12.0	517,679
		12.1 - 14.0	127,196
		adults	71
Stizostedion vitreum	Walleye	1.0 - 2.0	202,525
		2.1 - 4.0	179,201
		adults	25
Ictalurus furcatus	Blue Catfish	5.0	64,905
		10.1 - 12.0	5,120
Ictalurus punctatus	Channel Catfish	3.0	36,000
Micropterus salmoides	Largemouth Bass	1.0 - 2.0	342,770
Esox masquinongy	Tiger Muskie	6.0	6,000
Morone saxatilis	Striped Bass	1.0 - 2.0	37,658
		2.1 - 4.0	105,948
Dorosoma petensense	Threadfin Shad	3.1 - 5.0	50,000

Table 54. Creel Survey harvest information for paddlefish in Truman Lake in the West Osage River Basin in west-central Missouri.

YEAR *	SNAG HOURS	SNAG TRIPS	TOTAL CATCH RATE	NUMBER HARVESTED	AVG. WT (lbs) MALES	AVG. WT (lbs) FEMALES
1990	21,805	5,360	0.097	2,253	26.65	47.25
1991	35,808	7,921	0.085	2,386	28.38	50.63
1992	43,254	8,953	0.093	4,041	23.28	43.61
1993	31,148	4,862	0.094	1,852	23.97	50.66
1994	26,732	6,665	0.100	1,436	23.19	56.43
1995	21,092	6,679	0.130	1,167	16.31	39.56
1996	7,201	1,470	0.255	175	19.75	39.83

*1991 and 1993 roving creel only.
Table updated March 1999.